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# APPARATUS AND METHOD FOR FRACTIONATING GYPSUM SLURRY AND METHOD OF PRODUCING GYPSUM BOARD

## CROSS-REFERENCE TO RELATED APPLICATIONS

This is a nationalization of PCT/JP03/011677 filed Sep. 12, 2003 and published in Japanese.

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to an apparatus and a method for fractionating gypsum slurry and a method of producing gypsum board, and more specifically, to such an apparatus and a method for fractionating the gypsum slurry from a mixer for mixing calcined gypsum and water, and a method of producing the gypsum board with use of the apparatus for fractionating the gypsum slurry.

### 2. Related Art

Gypsum boards having a gypsum core covered with sheets of paper for gypsum board liner are practically and widely in use for an architectural interior finish material from viewpoints of its advantageous fire-resisting or fire-protecting ability, sound insulation performance, workability, cost performance and so on. In general, a process of producing such a gypsum board comprises a mixing step of admixing a quantity of water and foam (foam for reducing the weight of gypsum board core) with ingredients for the gypsum board, such as calcined gypsum, adhesive auxiliary agent, set accelerator, additives, admixtures and so forth; a slurry pouring step of pouring the produced gypsum slurry of the mixing step between upper and lower sheets of paper for gypsum board liner; a forming step of generally shaping the sheets and slurry so as to have a predetermined configuration of board; a severing and drying step of severing the continuous belt-like form of gypsum board into green boards and forcibly drying them; and a cutting step of finally cutting each of the dried boards to have a predetermined size of the product. In addition to such a widely used gypsum board, a lath board, decorative gypsum board, gypsum sheathing board, reinforced gypsum board and so forth are known in the art as board materials for building construction to be produced in accordance with similar methods. These board materials are defined in JIS (Japanese Industrial Standard; JIS A6901), as being various kinds of board materials to be selectable in correspondence with their purpose of use and performance, and they are actually placed on the market of building construction materials.

FIG. 12 is a schematic side view illustrating an arrangement of a conventional gypsum board manufacturing machine. In FIG. 12, there is shown a part of the machine, in which the mixing step, the slurry pouring step and the forming step are carried out.

The gypsum board manufacturing machine is provided with a mixer A which prepares the slurry by mixing the aforementioned ingredients for the gypsum board. A thin, pin-type mixer is used as the mixer A, in a lot of gypsum board manufacturing plants. In general, this kind of mixer comprises a flattened cylindrical housing which defines a mixing area (mixing chamber), and a rotary disc to be rotated within the housing. In a central area of an upper cover of the housing, there are located a plurality of inlet ports which introduces the materials to be mixed, such as calcined gypsum, mixing water and foam, into the housing. The housing is provided in its peripheral zone with a discharging port for discharging the

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mixture therethrough. The upper cover or upper plate is provided with a plurality of upper pins depending therefrom down to the proximity of the rotary disc. The rotary disc has a plurality of lower pins vertically fixed thereon and extending up to the proximity of the upper cover. The upper and lower pins are radially alternately arranged. A rotary shaft and a driving device for rotating the disc are connected with the disc. The components fed into the housing are stirred and mixed by rotation of the disc in operation of the driving device, and moved radially outward on the disc by the action of centrifugal force, and then, discharged onto a sheet of paper for gypsum board liner from a chute F located in a peripheral portion of the housing, as the gypsum slurry S1. This kind of mixer is disclosed in, for instance, U.S. Pat. Publication No. 3,459,620, Japanese Patent Laid-Open Publications Nos. 8-25342, 2000-262882 and 2000-6137, and so forth.

In the technical field of manufacture of gypsum boards, efforts of long years have been made to further reduce the weight of gypsum board while keeping or improving the quality thereof. For example, in the forcible drying step during manufacture of gypsum boards, the drying rate of the gypsum board is, in general, relatively quick at an edge part or edge zone (an edge portion), in comparison with its width-wise center part. Therefore, the edge portion is apt to cause lack of strength, dryout, defective bonding between the gypsum core and the gypsum board liner paper, and the like, owing to excessive drying. In order to prevent such a phenomenon, the density of slurry at the edge portions of the gypsum board is generally set to be higher than the density of slurry at the center part thereof.

For making the density of the side edge portions of gypsum board higher, an agitator for slurry (gypsum slurry agitator B) independent of the aforementioned mixer is normally used, as shown in FIG. 12. A part of gypsum slurry prepared by the mixer is fractionated through a slurry fractionation port E disposed on a peripheral outer wall of the mixer housing, and is introduced into the gypsum slurry agitator B rotating at a high speed. The agitator B causes the foam to be broken or disappear so that the gypsum slurry with high density is obtained, and deposits the high density gypsum slurry S2 on a zone of the gypsum board liner paper corresponding to the edge portion of gypsum board. This type of gypsum slurry agitator is called a hard edge mixer, and employment of such a hard edge mixer makes it possible to form a high density (high specific gravity) core at the edge parts of gypsum board without making the density (specific gravity) of the center part of gypsum board higher. This kind of gypsum slurry agitator is disclosed, e.g., in U.S. Pat. Publication No. 4,279,673.

The gypsum slurry of the mixer is also fractionated through slurry fractionation ports E', E'' disposed on the peripheral outer wall of the mixer, and it is fed to gypsum slurry agitators C, D for roll coaters G, H. The agitators C, D agitates the gypsum slurry to discharge the high-density gypsum slurry S', S'' onto the gypsum board liner paper. Each of the roll coaters forms a thin layer of high-density slurry on the surface of the sheet for improving the adhesiveness between the gypsum core and the paper.

Further, a mixer disclosed in Publication of PCT International Application No. WO 97-23337 has an arrangement in which inlets for feeding materials to be mixed, except foam, are disposed in a center area of the mixer. The mixer prepares gypsum slurry without foam in the mixer, and discharges it through a main discharge outlet as a core stream. A part of the slurry in the mixer is extracted as an edge stream, through an auxiliary slurry discharge outlet disposed on a peripheral